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# Fish Habitat Enhancement Potential And Stocking Assessment Of Bruce Lake

R. J. Zemlak and A. R. Langston
1994

PWFWCP Report No. 123

The Peace/Williston Fish & Wildlife Compensation Program is a cooperative venture of BC Hydro and the provincial fish and wildlife management agencies, supported by funding from BC Hydro. The Program was established to enhance and protect fish and wildlife resources affected by the construction of the W.A.C. Bennett and Peace Canyon dams on the Peace River, and the subsequent creation of the Williston and Dinosaur Reservoirs.

**Peace/Williston Fish and Wildlife Compensation Program, 1011 Fourth Ave. 3rd Floor, Prince George B.C. V2L 3H9**

Website: *www.bchydro.bc.ca/environment/initiatives/pwcp/*

This report has been approved by the Peace/Williston Fish and Wildlife Compensation Program Fish Technical Committee.

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Author(s): Randy J. Zemlak[1] and Arne Langston[1]
Address(es): [1] Peace/Williston Fish and Wildlife Compensation Program, 1011 Fourth Ave., 3rd Floor Prince George, B.C. V2L 3H9

105-02876/

# BRUCE LAKE

WATERSHED: Parsnip River

DATE OF SURVEY: October 3. 4. 5. 1994

FIELD CREW LEADER: A. R. Langston

FIELD ASSISTANT: R. J. Zemlak

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ENVIRONMENTAL AFFAIRS

and

B.C. ENVIRONMENT

FISH AND WILDLIFE BRANCH

REPORT PREPARED BY: R. T. Zemlak / A. R. Langston

Lake: **Bruce**

## INTRODUCTION

A standard fisheries baseline reconnaissance survey of Bruce Lake was carried out by the Peace/Williston Fisheries Compensation Program (Prince George) in July of 1989. The report is on file at the Ministry of Environment, Lands and Parks, Fish and Wildlife Branch, Prince George.

Bruce Lake was investigated in October of 1994 by the Peace/Williston Fisheries Compensation Program to identify potential fisheries enhancement projects and to evaluate the success of the 1989 rainbow trout stocking.

## STOCKING HISTORY

Bruce Lake was stocked once with rainbow trout in 1989 (Table #1). The stocking history of Bruce Lake is located in Table 1.

**TABLE 1**
**BRUCE LAKE STOCKING HISTORY**

| Year | Species | Number | Size (grams) | Stage | Stock |
|---|---|---|---|---|---|
| 1989 | Rainbow trout | 17,000 | 1.09 | Fall fry | Dragon |

## LOCATION

| | | |
|---|---|---|
| Location: | 23 km SE of Mackenzie (Fig. 1) | |
| Elevation: | 747 m + | |
| Latitude/Longitude: | 55°08'29":122°54'49" | U.T.M.: 10.5056.61103 |
| Management Unit: | 7-30 | N.T.S. Map No.: 93 O/2 |

Drainage: Outlet C -->swamp (closed system)

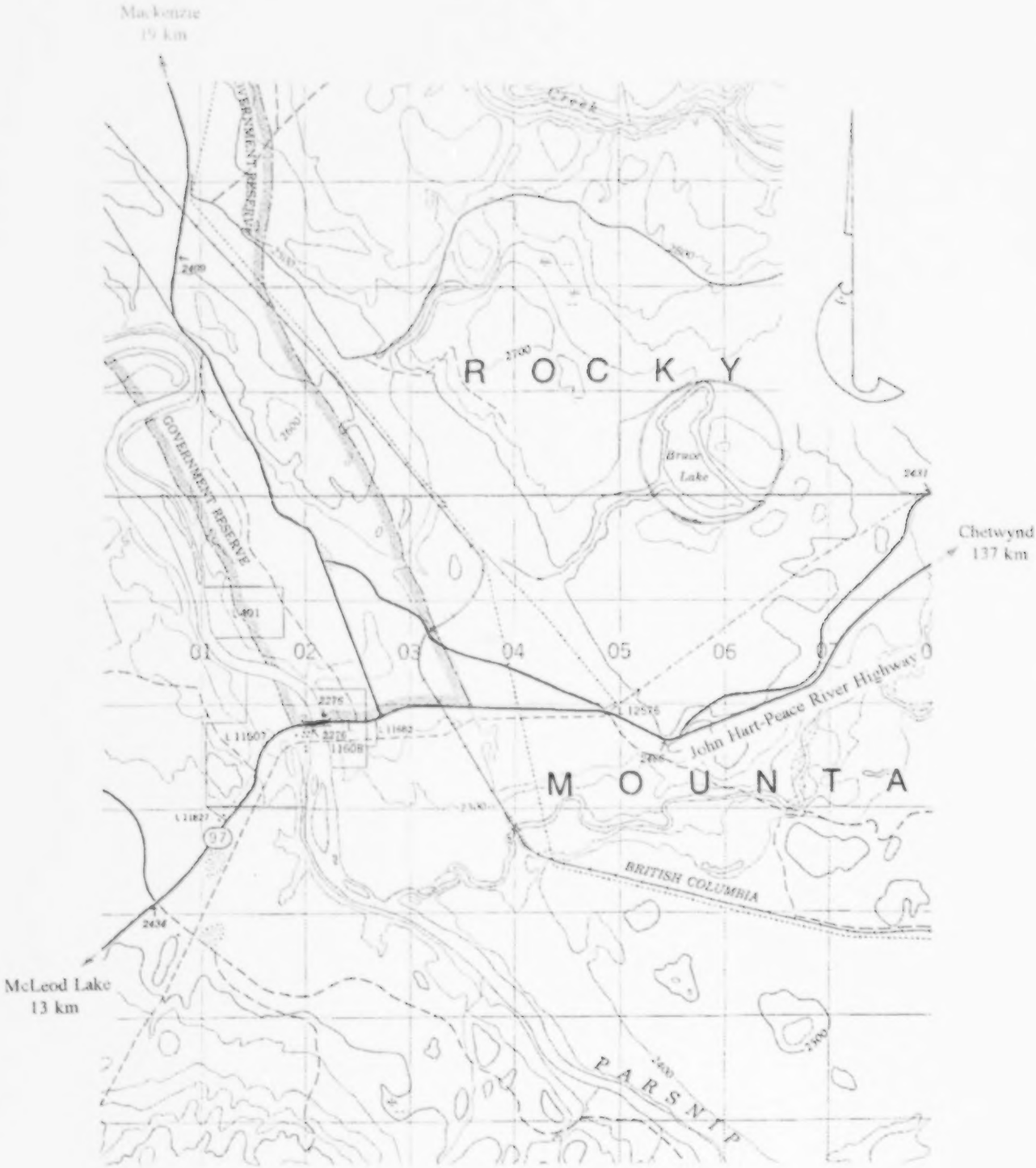


**Figure 1.** Location of Bruce Lake. 1 : 50,000

## METHODS

Three sinking monofilament gill nets (a 18, a 16, and a 6.5 hour set) and two minnow traps baited with sardines (both 19 hour sets), were used to determine relative abundance and identification of fish species in Bruce Lake (See Appendix 1 for net set details) (See Fig. 2 for net set locations).

Rainbow trout were sampled for length, weight, sex, maturity, stomach contents, and parasite/disease presence (Appendix 2). Scale samples were collected for age determination. General appearance of the rainbow trout were recorded by visual analysis.

Potential fisheries enhancements of one inlet and the outlet were determined through visual observations and recording of physical data using standard methodologies outlined in the Fish/Habitat Inventory and Information Program (1987 Stream Survey Field Guide).

Rainbow trout catch per unit effort information (fish/rod hour) was calculated from angling undertaken by program staff.

The benchmark set during the initial study (1989) was located and repainted (Fig. 2). Any change in water level was measured using a Suunto clinometer, a two meter measuring pole, and an Eslon tape.

Photo documentation of the investigation was also completed (Appendix 3). Plate #1 provides a panoramic view of Bruce Lake looking east.

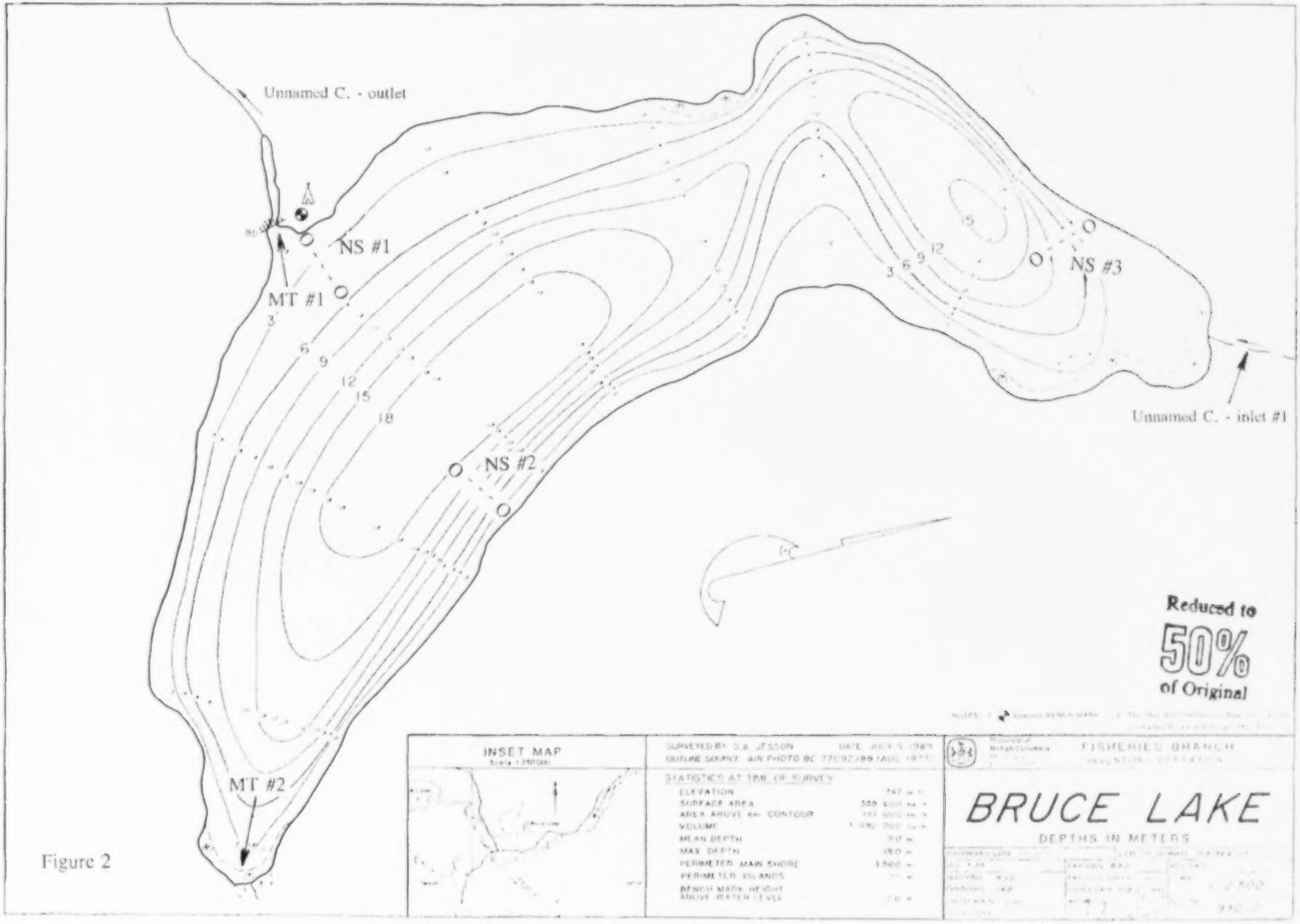
Unnamed C. - outlet
NS #1
MT #1
NS #3
NS #2
MT #2
Unnamed C. - inlet #1
3
6
9
12
15
18
Reduced to
50%
of Original
INSET MAP
SURVEYED BY D.A. JESSON
DATE JULY 5 1987
OUTLINE SOURCE AIR PHOTO BC 77027:89 AUG 1977
STATISTICS AT TIME OF SURVEY
ELEVATION
SURFACE AREA
AREA ABOVE 6m CONTOUR
VOLUME
MEAN DEPTH
MAX DEPTH
19.0 m
PERIMETER MAIN SHORE
3500 m
PERIMETER ISLANDS
BENCH MARK HEIGHT ABOVE WATER LEVEL
FISHERIES BRANCH
BRUCE LAKE
DEPTHS IN METERS

Figure 2

Lake: **Bruce**

## RESULTS & DISCUSSIONS

Three net sets, fishing for a total of 40.5 hours, yielded two rainbow trout and twelve lake chub (Table 2). Although, one rainbow trout escaped before it could be sampled. Two minnow traps, fishing for a total of 38 hours, yielded 131 lake chub (Table 3). Average fork length, weight, and condition factor were calculated on two rainbow trout captured in the overnight net sets and by anglers (Table 4).

In 1989, one net set, which fished for sixteen hours, captured twelve lake chub. Also, two minnow traps, which fished for 32.75 hours, yielded 328 lake chub in 1989.

### TABLE 2
### LAKE CATCH SUMMARY

| | Net Site Number | | | | Angled | Other | Total | Number | Size (cm) |
|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | | | | | |
| rainbow trout | 1 | 0 | 1 | | 1 | 0 | 3 | 2 | 53.4 - 54.0 |
| lake chub | 2 | 0 | 10 | | 0 | 0 | 12 | 0 | 9.0 - 11.0 |

### TABLE 3
### MINNOW TRAP CATCH SUMMARY

| # | Hours fished | Depth | Substrate | Species | Total | Mean Length |
|---|---|---|---|---|---|---|
| 1 | 19 | 0.5 m | cobble/silt cover | Lake chub | 33 | 8.5 cm |
| 2 | 19 | 0.3 m | organics<br>aquatic vegetation | Lake chub | 98 | 7.5 cm |

### TABLE 4
### AVERAGE LENGTH, WEIGHT, AND CONDITION FACTOR

| Rainbow Trout | Fork Length (cm) | Weight (g) | Condition Factor |
|---|---|---|---|
| Max | 54.0 | 2100 | 1.33 |
| Mean | 53.7 | 2015 | 1.30 |
| Min | 53.4 | 1930 | 1.27 |
| S D | 4.2 | 120.2 | |

Condition Factor Formula: $k = (W(\text{grams}) \times 100)/L(\text{cm})^3$

Lake: **Bruce**

**Length vs Age**

An indication of growth rate is provided through the length/age relationship of two rainbow trout captured by the net sets and by angling (Table 5, Fig. 3).

**TABLE 5**
**LENGTH/AGE RELATIONSHIP**

| Age | Sample Size | Max L. (cm) | Mean L. (cm) | Min L.(cm) | S D |
|---|---|---|---|---|---|
| 5 + | 2 | 54.0 | 53.7 | 53.4 | 0.4 |

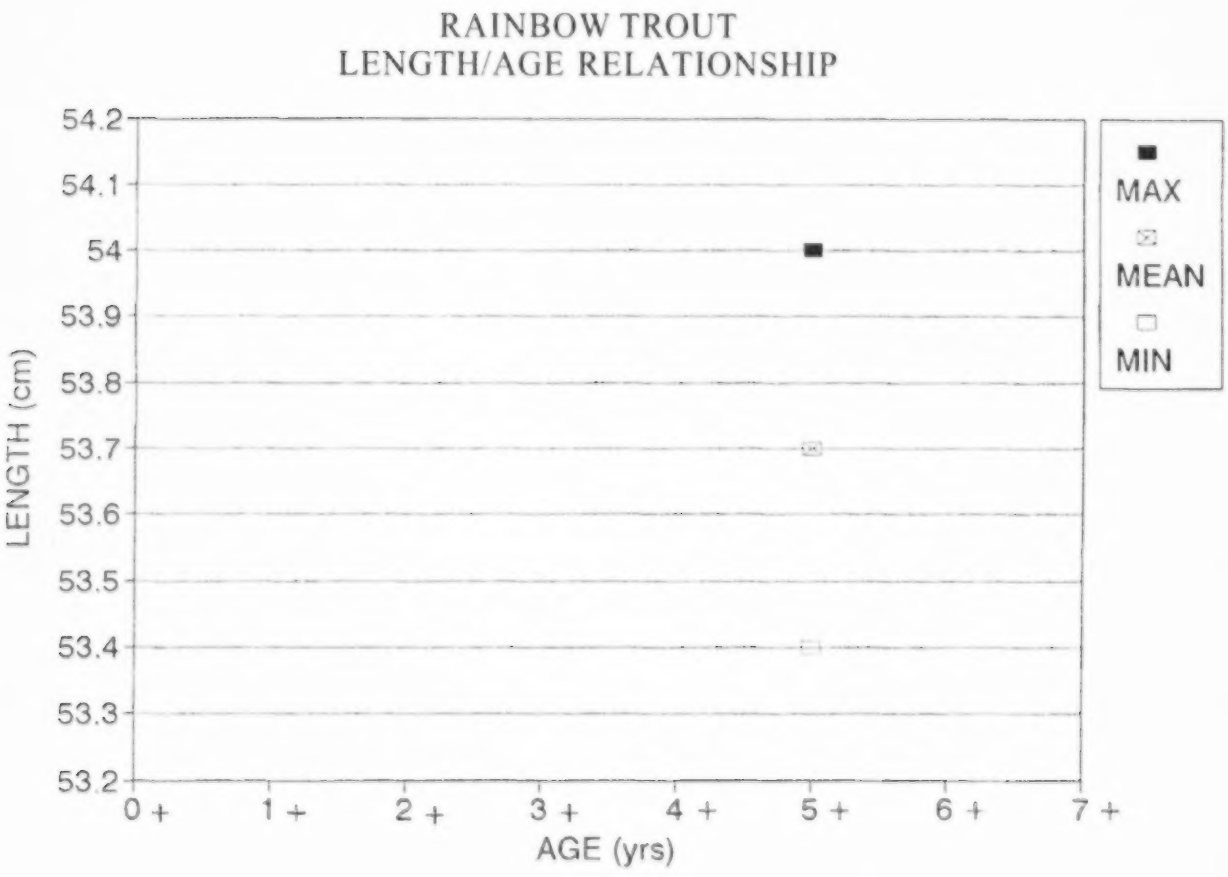


**Figure 3**

Lake: **Bruce**

**Length vs Weight**

The length/weight relationship of two rainbow trout captured in the net sets and by angling are shown in figure 4.

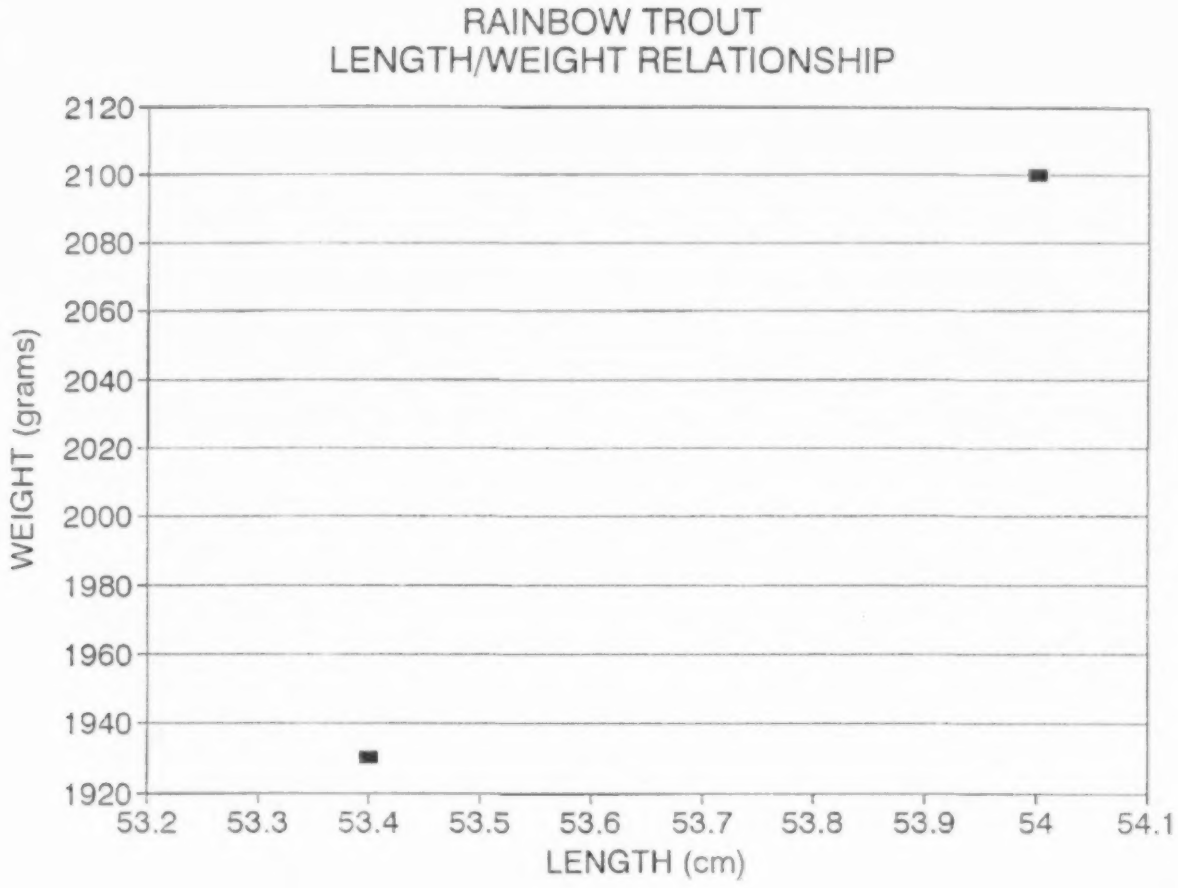


**Figure 4**

## BIOLOGICAL ANALYSIS OF RAINBOW TROUT

The rainbow trout captured during the investigation consisted of two females. A biological analysis was conducted on one of the two rainbow trout captured. Reproductive organ analysis revealed that one of the females was maturing and would have been in spawning condition in the spring of 1995. This female had new eggs developing in the skein. Spawnbound may be present as small hard eggs were noticed loose in the body cavity and spawning colours were evident on this female.

A stomach contents examination revealed a diet of mainly insects (Diptera and Dragon fly nymphs). Freshwater shrimp comprised the rest of the stomach contents (Appendix 2).

The rainbow trout in Bruce Lake appeared healthy. No parasites or diseases were observed.

## DRAINAGE

Unnamed C. - inlet *#1*

This small intermittent creek is heavily overgrown and enters the north end of the lake. The creek drains a low lying area. No water was observed in this inlet at the time of this survey. This inlet has no fisheries value.

Unnamed C. - outlet (Plate #2, #3, #4, #5, #6)

The outlet drains from the southwest end of Bruce Lake. Lake level is controlled by a beaver dam (0.5 m in height by 29 m in length) located at the lake outlet. Fish passage over this dam was impossible at the time of the survey, and no water was observed flowing over the top of the dam. A second beaver dam (1.0 m in height by 27 m in length) is located 100 m downstream of the lake. A third beaver dam (0.2 m in height by 25 m in length) is located 115 m downstream of the lake. Water was observed flowing over and seeping through the third beaver dam. A fourth beaver dam (1.1 m in height by 12 m in length) is located 215 m downstream of the lake. Lake chub were observed in a pond below the fourth beaver dam. A fifth beaver dam (0.5 m in height by 5 m in length) is located 225 m downstream of the lake. Water was observed flowing over the top of the fifth beaver dam. A point card was completed for the outlet (See Appendix 4 for tributary stream data). Approximately 120 m downstream from the lake, the outlet had an average wetted width of 1.0 m, average depth of 10 cm, gradient of 1%, and a water temperature of 9.0° C. The bottom substrate consists of a surface layer of varying depths of organics overlying cobble and boulders.

Unnamed C. - outlet (continued)

The outlet creek is approximately 2 km in length and flows into a swamp. The railroad track (Fig. 1) denotes the end of the creek. The outlet creek is not connected with the Parsnip River as was reported in the 1989 Reconnaissance survey. Bruce Lake is a closed system.

## ANGLER USE AND CATCH PER UNIT EFFORT

No on site anglers were present at the time of this survey. Creel information was gathered from our own angling efforts (2 people). Angling catch per unit effort was calculated at 0.2 rainbow trout per rod hour.

## BENCHMARK

The original benchmark set in 1989 was located. This benchmark is located on the west shore, 5.5 m from the water's edge in a 20 cm diameter spruce tree. The benchmark was set at an initial height above water level of 2.0 meters. The benchmark was 2.18 m above the current lake level indicating a 18 cm drop in water level. The benchmark was re-painted orange.

## RESORTS AND CAMPSITES

Present lake access is by a five minute helicopter flight from the Mackenzie Junction (junction of Highway 97 and Highway 39). During winter, recreationalists access Bruce Lake by snowmobile. There are no developed camp areas; however, there was evidence of an old fire pit on the west shore near the outlet.

## FISHERIES MANAGEMENT COMMENTS

Bruce Lake is a closed system which was barren of all salmonid species prior to stocking in 1989. This lake supports a relatively small population of larger rainbow trout (stocked, 1989). The rainbow trout captured during the investigation have a healthy appearance and appear to be in good condition (C.F. 1.3 (1.27 - 1.33)) (Appendix 5). No spawning habitat was identified for these fish. Stomach content analysis revealed that rainbow trout are targeting insects as a primary food source. The lake level is controlled by a beaver dam (0.5 m in height) located at the outlet. Four of the five beaver dams were breached. Only the beaver dam controlling the lake level was not breached. Mostly organics remained in the resulting drawdown ponds. Once the organics were removed, a hard bottom of cobble and boulders remained (Plate #7). Rearing habitat was poor. Lake chub were noted within the outlet, but could not swim back to the lake.

Lake: **Bruce**

## STOCKING PROGRAM

The one time stocking of rainbow trout fall fry in 1989 was successful but the few remaining fish have reached the end of their life span.

Angler use has been reported by Jim Ladds (B.C. Forest Service). The use of Bruce Lake, particularly for ice fishing, is declared to be high enough to justify a low intensity stocking program.

Post survey note: Bruce Lake will be stocked with brook trout fingerlings in 1995. "After an initial stocking of 10,000 brook trout in 1995, stocking every second year with 5,000 brook trout will maintain a low to moderate use fishery" (D. Jesson, Ministry of Environment, Lands and Parks). A stocking assessment two to three years after the initial brook trout stocking is recommended in order to gauge survival and growth.

## ENHANCEMENT POTENTIAL

The unnamed outlet creek had flows too low at the time of the survey to accommodate salmonid spawning (Appendix 3). Flows may be adequate during May and June to enable rainbow trout to spawn and promote recruitment. Flows are not adequate in the fall to facilitate spawning and recruitment of brook trout. An investigation in early June is required to examine the outlet flows. If flows are determined to be adequate, an enhancement of the initial 225 m of the outlet creek could be possible.

With the combination of beaver dam removal, gravel addition, and habitat complexing, a one time stocking of rainbow trout could result in a naturalized stock. Beaver control materials like fencing would be required to prevent further beaver activity. Further fish stockings may be few or unnecessary. Machine access is not currently available; however, a gas pipeline road passes within 2 km of the lake. A road following the outlet creek would have to be built to enable enhancements. Enhancement of the outlet creek affords the possibility of public involvement.

## REFERENCES

DFO/MOE. 1987. Stream Survey Field Guide. Fish Habitat Inventory and Information Program. 33p.

# APPENDIX 1

## Netting Record

Lake: **Bruce**

**NETTING RECORD**

Sinking monofilament gill net
Number of panels: 6
Individual panel length: 15.2 m
Mesh size experimental order: 25, 76, 51, 89, 38, 64 mm

**NETTING SITE # 1**

| | | |
|---|---|---|
| Date Set: | October 3, 1994 | Time: 15:15 hrs |
| Date Lifted: | October 4, 1994 | Time: 10:15 hrs |
| Net Dimensions: | Length: 91.4 m | Width: 2.4 m |
| Shallow End Mesh Size: | 25 mm | Depth: 0.8 m |
| | Substrate: cobble and silt | |
| Deep End Mesh Size: | 64 mm | Depth: 5.0 m |
| | Substrate: organics | |

**NETTING SITE # 2**

| | | |
|---|---|---|
| Date Set: | October 4, 1994 | Time: 10:30 hrs |
| Date Lifted: | October 4, 1994 | Time: 17:00 hrs |
| Net Dimensions: | Length: 91.4 m | Width: 2.4 m |
| Shallow End Mesh Size: | 25 mm | Depth: 1.0 m |
| | Substrate: organics | |
| Deep End Mesh Size: | 64 mm | Depth: 18.0 m |
| | Substrate: organics | |

**NETTING SITE # 3**

| | | |
|---|---|---|
| Date Set: | October 4, 1994 | Time: 17:15 hrs |
| Date Lifted: | October 5, 1994 | Time: 10:15 hrs |
| Net Dimensions: | Length: 91.4 m | Width: 2.4 m |
| Shallow End Mesh Size: | 25 mm | Depth: 1.0 m |
| | Substrate: organics | |
| Deep End Mesh Size: | 64 mm | Depth: 11.0 m |
| | Substrate: unknown | |

# APPENDIX 2

## Individual Fish Data

Lake: **Bruce**

## INDIVIDUAL FISH DATA

Date Captured: October 3, 1994

Method of Capture: Angling.

M - Male
F - Female
? - Not Obvious
SP - Spent

IMM - Immature
MG - Maturing
MT - Mature
GV - Gravid
OT - Otolith
? - Not Obvious

EG - EGG
FR - FinRay
HD - Head
ML - Milt

SC - Scale
ST - Stoma
TG - Fish T
WF - Whol Fish

| SPECIES | Fork Length (cm) | Weight (grams) | Sex | Gonadal Maturity | Sample Type | Age (yr) | Stomach Contents | | | | COMMEN |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Plankton | Insects | Fish | Other | |
| Rainbow trout | 54.0 | 2100 | F | | SC | 5 + | | | | | |

## INDIVIDUAL FISH DATA

Date Captured: October 4, 1994

Method of Capture: Sinking monofilament gill net #3.

M - Male
F - Female
? - Not Obvious
SP - Spent

IMM - Immature
MG - Maturing
MT - Mature
GV - Gravid
OT - Otolith
? - Not Obvious

EG - Egg
FR - Fin Ray
HD - Head
ML - Milt

SC - Scale
ST - Stomach
TG - Fish Tag
WF - Whole Fi

| SPECIES | Fork Length (cm) | Weight (grams) | Sex | Gonadal Maturity | Sample Type | Age (yr) | Stomach Contents | | | | COMMENT |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Plankton | Insects | Fish | Other | |
| Rainbow trout | 53.4 | 1930 | F | MG | SC | 5 + | | Diptera Dragon fly nymph | | Freshwater shrimp | |

AGE DETERMINATION COMPLETED BY:
**Margaret Macdonald, Box 243, Midway, B.C.**

AGE DETERMINATION VERIFIED BY:
**Arne Langston, Peace/Williston Fisheries Compensation Program, Prince George, B.C.**

# APPENDIX 3

## Photograph Directory

Lake: **Bruce**

**PHOTOGRAPH DIRECTORY**

| Negative # | Plate # | Description |
|---|---|---|
| Roll A : 22 & 23: | 1 | Panoramic view of Bruce Lake looking east, taken from beaver dam #1 (outlet creek). |
| Roll A : 19 | 2 | Upstream view of beaver dam #1 from beaver dam |
| Roll A : 24 | 3 | Upstream view of beaver dam #2 from beaver dam #3. |
| Roll B : 1 | 4 | Upstream view of beaver pond from beaver dam #4 (beaver dam #3 not visible from this angle). |
| Roll B : 3 | 5 | Upstream view of beaver dam #4. |
| Roll B : 17 | 6 | View of outlet creek (beaver dam #1 which controls the lake level) |
| Roll B : 12 | 7 | View of resulting bottom material after beaver dam #3 was breached. |

Lake: Bruce

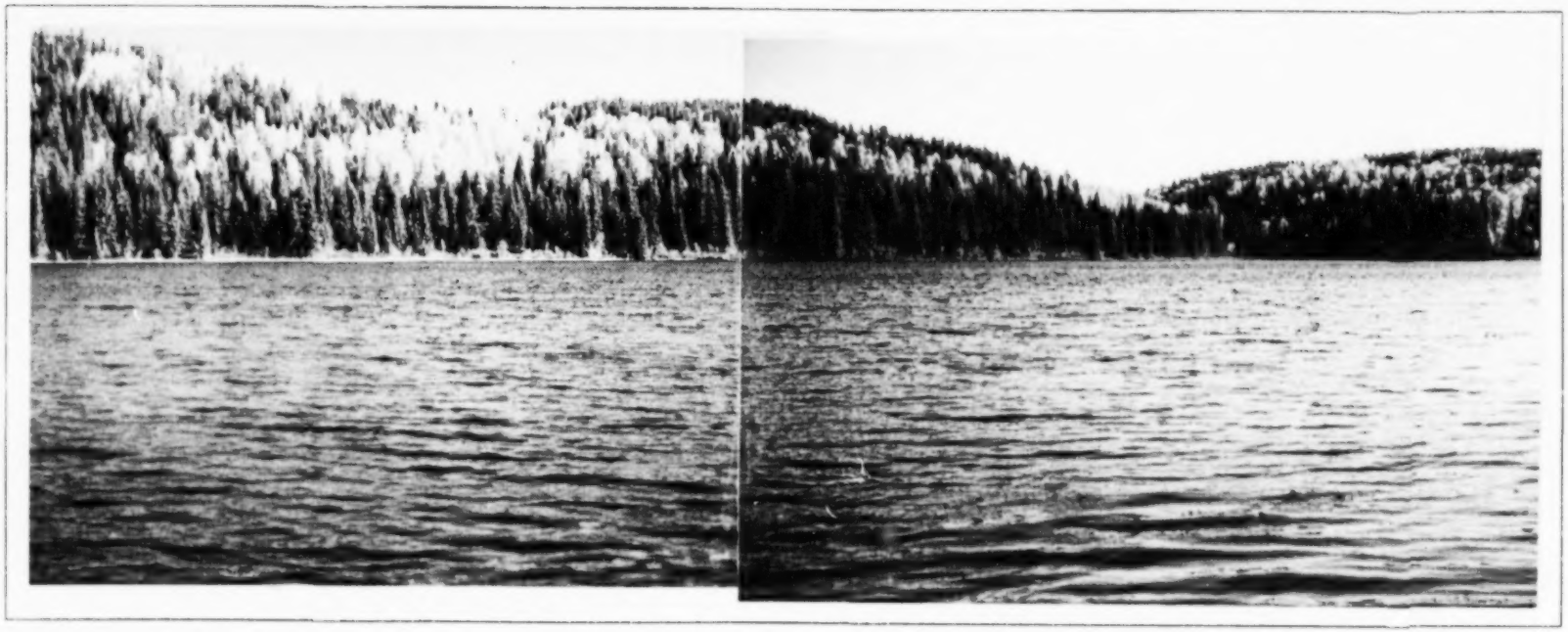

**Plate 1:** Panoramic view of Bruce Lake looking east. Picture taken from the outlet creek.

**Plate 2:** Upstream view of beaver dam #1 from beaver dam #2.

**Plate 3:** Upstream view of beaver dam #2 from beaver dam #3.

Lake: **Bruce**

**Plate 4:** Upstream view of pond between beaver dam #3 and #4.

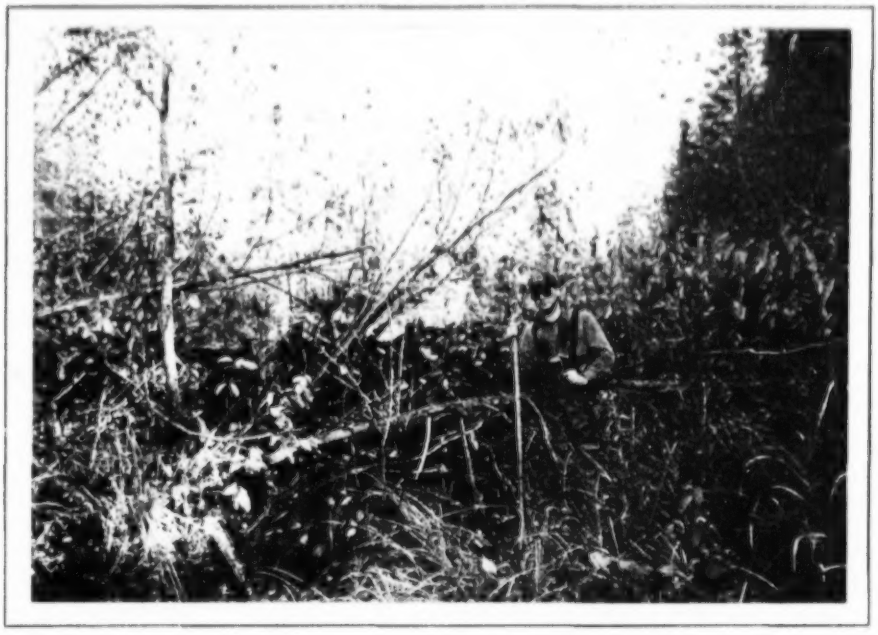

**Plate 5:** Upstream view of beaver dam #4.

**Plate 6:** View of the outlet creek from the lake. Note beaver dam #1 controls the lake level.

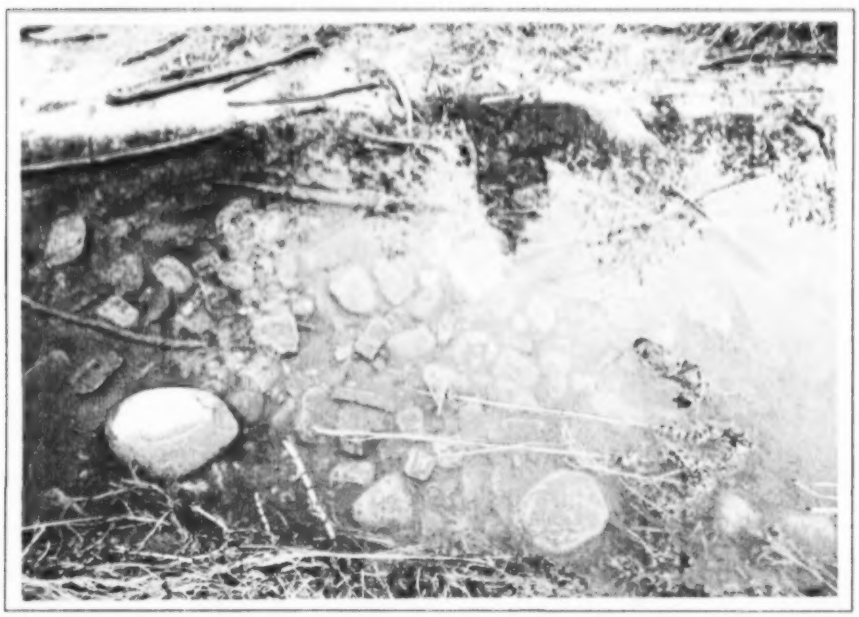

**Plate 7:** View of the resulting bottom substrate after beaver dam #3 was breached.

# APPENDIX 4

Tributary Stream Data

Lake: **Bruce**

**System Name:** **Unnamed C.** **outlet #1**

**Site Location:** Sample Site #1 (beaver dam #3), located approximately 120 m downstream of outlet.

| | | | |
|---|---|---|---|
| Date: | October 5, 1994 | Time: | 11:00 hrs |
| Channel Width: | see comments | Water Temp.: | 9.0 °C |
| Wetted Width: | 1.0 m | Stage (flow) | low |
| Max. Depth: | 30 cm | Velocity: | 0.03 m/sec |
| Ave. Depth: | 10 cm | Field Gradient: | 0.0 % |
| Turbidity: | 30 cm | Colour: | Crystal clear |

Flood Signs:
Height: see comments
Type: see comments

**Substrate Breakdown:**

| Fines | Small Gravel | Large Gravel | Cobble |
|---|---|---|---|
| 60 % | 10 % | 10 % | 10 % |

| Boulder | Bedrock |
|---|---|
| 10 % | -- % |

**Substrate Compaction:** see comments

**Banks:**

| | Form | Height | Stability |
|---|---|---|---|
| **Right** | see comments | see comments | see comments |
| **Left** | see comments | see comments | see comments |

**Comments:**

1) Creek altered due to beaver dam presence.
2) Point sample card was completed after beaver dam #3 was breached.
3) Bank form consists of a beaver dam composed of logs, twigs, rocks, and mud.
4) Left and right banks are the height of the beaver dam (0.2 m).
5) Bank stability is high.
6) Bottom substrate consists of mainly cobble and boulder.
7) Silt and organic content is artificially high due to breaching.
8) Ground estimate reveals that the field gradient is approximately 1% (1m / 100m).

Lake: Bruce

## APPENDIX 5

## Individual Length, Weight, and Condition Factor

Lake: **Bruce**

## INDIVIDUAL LENGTH, WEIGHT, AND CONDITION FACTOR

| SPECIES | FORK LENGTH (cm) | WEIGHT (g) | CONDITION FACTOR |
|---|---|---|---|
| Rainbow trout | 54.0 | 2100 | 1.33 |
| Rainbow trout | 53.4 | 1930 | 1.27 |